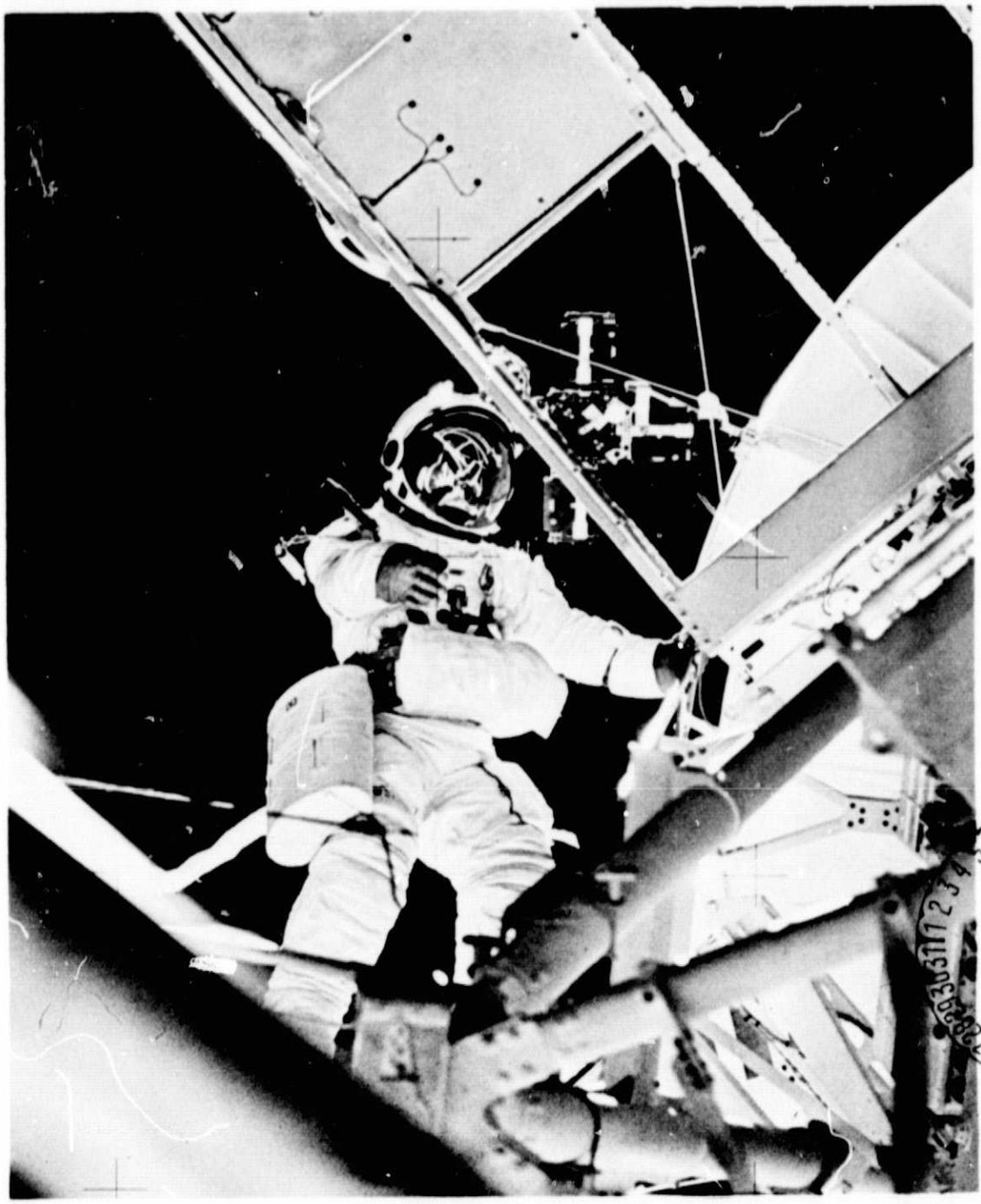

HISTORY of MANNED SPACE FLIGHT

JOHN F. KENNEDY SPACE CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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NASA MANNED SPACE FLIGHTS

Project	Date	Crew	Time in Space	Orbits/Revs
MERCURY				
Mercury Redstone 3 "Freedom 7"	May 5, 1961 Recovery Ship - Champlain (A)**	Naval Comdr. Alan B. Shepard	0:15:22	suborbital
Mercury Redstone 4 "Liberty Bell 7"	July 21, 1961 Recovery Ship - Randolph (A)	Air Force Maj. Virgil I. Grissom	0:15:37	suborbital
Mercury Atlas 6 "Friendship 7"	Feb. 20, 1962 Recovery Ship - Noa (A)	Marine Lt. Col. John H. Glenn	4:55:23	three orbit
Mercury Atlas 7 "Aurora 7"	May 24, 1962 Recovery Ship - Pierce (A)	Naval Lt. Comdr. Scott Carpenter	4:56:05	three orbit
Mercury Atlas 8 "Sigma 7"	Oct. 3, 1962 Recovery Ship - Kearsarge (P)	Naval Comdr. Walter M. Schirra	9:13:11	six orbits
Mercury Atlas 9 "Faith 7"	May 15-16, 1963 Recovery Ship - Kearsarge (P)	Air Force Maj. L. Gordon Cooper	34:19:49	22 orbits
		* * * *		
GEMINI				
Gemini 3 "Molly Brown"	March 23, 1965 Recovery Ship - Intrepid (A)	Air Force Maj. Virgil I. Grissom Naval Lt. Comdr. John W. Young	4:53	three orbits
Gemini 4 EVA - 20 Min.	June 3 - 7, 1965 Recovery Ship - Wasp (A)	Air Force Majors James A. McDivitt Edward H. White, II	97:56	62 revs.

** A or P after recovery ship denotes Atlantic or Pacific Ocean

- more -

Project	Date	Crew	Time in Space	Orbits/Revs
Gemini 5	Aug. 21-29, 1965 Recovery Ship - Lake Champlain (A)**	Air Force Lt. Col. L. Gordon Cooper Naval Lt. Comdr. Charles Conrad, Jr.	190:56	120 revs.
Gemini 6	Dec. 15-16, 1965 Recovery Ship - Wasp (A)	Naval Capt. Walter M. Schirra Air Force Maj. Thomas P. Stafford	25:51	16 revs.
Gemini 7	Dec. 4-18, 1965 Recovery Ship - Wasp (A)	Air Force Lt. Col. Frank Borman Naval Comdr. James A. Lovell	330:35	206 revs.
Gemini 8	Mar. 16, 1966 Recovery Ship - Leonard F. Mason (P)	Neil A. Armstrong, Civilian Air Force Maj. David R. Scott	10:42	7 revs.
Gemini 9A Umbilical EVA of 2 hrs. 7 min. by Cernan	June 3-6, 1966 Recovery Ship - Wasp (A)	Air Force Lt. Col. Thomas P. Stafford Naval Lt. Comdr. Eugene A. Cernan	72:21	44 revs.
Gemini 10 Umbilical EVA of 39 min. and stand-up EVA of 49 min. by Collins	July 18-21, 1966 Recovery Ship - Guadalcanal (A)	Naval Comdr. John W. Young Air Force Maj. Michael Collins	70:47 (highest altitude	43 revs. 475 statute miles)
Gemini 11 Umbilical EVA of 33 min. and stand-up EVA of 2 hrs. 5 min. by Gordon	Sept. 12-15, 1966 Recovery Ship - Guam (A)	Naval Comdr. Charles Conrad Naval Lt. Comdr. Richard F. Gordon, Jr.	71:17 (highest altitude	44 revs. 853 statute miles)

** A or P after recovery ship denotes Atlantic or Pacific Ocean

Project	Date	Crew	Time in Space	Orbits/Revs
Gemini 12 2 standup EVAs of 2 hrs. 29 min. & 55 min.; Umbilical EVA of 2 hrs. 6 min. by Aldrin	Nov. 11-15, 1966 Recovery Ship - Wasp (A) **	Naval Capt. James A. Lovell, Jr. Air Force Maj. Edwin E. Aldrin, Jr.	94:35	59 revs.

* * * *

APOLLO				
Apollo 7	Oct. 11-22, 1968 Recovery Ship - Essex (A)	Naval Capt. Walter M. Schirra Air Force Maj. Donn Eisele Civilian Walter Cunningham	260:8:45	163 revs.
Apollo 8	Dec. 21-27, 1968 Recovery Ship - Yorktown (P)	Air Force Col. Frank Borman Naval Capt. James A. Lovell, Jr. Air Force Lt. Col. William Anders	147:00:11	10 revs. of Moon
Apollo 9 (Gumdrop and Spider)	March 3-13, 1969 Recovery Ship - Guadalcanal (A)	Air Force Col. James A. McDivitt Air Force Col. David R. Scott Civilian Russell L. Schweickart	241:00:53	151 revs. of Earth
Apollo 10 (Charlie Brown and Snoopy)	May 18-26, 1969 Recovery Ship - Princeton (P)	Air Force Col. Thomas P. Stafford Navy Comdr. John W. Young Navy Comdr. Eugene A. Cernan	192:03:23	31 revs. of Moon
Apollo 11 (Columbia, Eagle, Tranquillity Base)	July 16-24, 1969 Recovery Ship - Hornet (P)	Civilian Neil A. Armstrong Air Force Lt. Col. Michael Collins Air Force Col. Edwin E. Aldrin, Jr.	195:18:35	First lunar landing; Sea of Tranquillity; 1 EVA 2 hrs. 31 min., 44 lbs. lunar material
Apollo 12 (Yankee Clipper and Intrepid)	Nov. 14-24, 1969 Recovery Ship - Hornet (P)	Navy Comdr. Charles Conrad, Jr. Navy Comdr. Richard F. Gordon, Jr. Navy Comdr. Alan L. Bean	244:36:25	Second lunar landing; Ocean of Storms; 2 EVAs total 7 hrs. 39 min., 75 lbs. lunar material

** A or P after recovery ship denotes Atlantic or Pacific Ocean

Project	Date	Crew	Time in Space	Orbits/Revs.
Apollo 13 (Odyssey and Aquarius	April 11-17, 1970 Recovery Ship – Iwo Jima (P)	Navy Capt. James A. Lovell, Jr. Civilian Fred W. Haise, Jr. Civilian John L. Swigert, Jr.	142:54:41	Planned lunar landing aborted after oxygen tank rupture
Apollo 14 (Kitty Hawk and Antares)	Jan. 31 – Feb. 9, 1971 Recovery Ship – New Orleans (P)	Navy Capt. Alan B. Shepard Air Force Maj. Stuart A. Roosa Navy Commander Edgar D. Mitchell	216:42:01	Third lunar landing; Fra Mauro; 2 EVAs total 9 hrs. 25 min., returned 98 lbs. lunar material
Apollo 15 (Endeavour and Falcon)	July 26 – Aug. 7, 1971 Recovery Ship – Okinawa (P)	Air Force Col. David R. Scott Air Force Lt. Col. James B. Irwin Air Force Maj. Alfred M. Worden, Jr.	295:12	Fourth lunar landing; Hadley Apennine; 3 surface EVAs. totaling 18 hrs. 36 min., returned 173 lbs. samples
Apollo 16 (Casper and Orion)	April 16-27, 1972 Recovery Ship – USS Ticonderoga (P)	Navy Capt. John W. Young Navy Lt. Commander Thomas K. Mattingly, II Air Force Lt. Col. Charles M. Duke, Jr.	265:51:06	Fifth lunar landing; Descartes highlands; 3 surface EVAs totaling 20 hrs. 14 min., returned 210 lbs. samples
Apollo 17 (America and Challenger)	Dec. 7-19, 1973 Recovery Ship – USS Ticonderoga (P)	Navy Capt. Eugene A. Cernan Navy Commander Ronald E. Evans Civilian Harrison H. Schmitt (Ph.D.)	301:51:59	Sixth lunar landing; Taurus-Littrow; 3 surface EVAs totaling 22 hrs. 4 min., returned 243 lbs. samples
Skylab 2	May 25 – June 22, 1973 Recovery Ship – USS Ticonderoga (P)	Navy Capt. Charles Conrad Navy Commander Paul J. Weitz Navy Commander Joseph Kerwin (M.D.)	28 days 49 min.	404 revolutions 392 experiment hours
Skylab 3	July 28 – Sept. 25, 1973 Recovery Ship – USS New Orleans (P)	Navy Capt. Alan L. Bean Marine Maj. Jack R. Lousma Civilian Owen Garriott (Ph.D.)	59 days 11 hrs. 9 min.	858 revolutions 1081 experiment hours
Skylab 4	Nov. 16, 1973 – Feb. 8, 1974 Recovery Ship – USS New Orleans (P)	Marine Lt. Col. Gerald P. Carr USAF Lt. Col. William R. Pogue Civilian Edward G. Gibson (Ph.D.)	84 days 1 hr. 16 min.	1214 revolutions 1563 experiment hours

Totals: Flights – 30; Astronauts participating – 44; cumulative man hours in space – 21,759:42

MANNED SPACE FLIGHT COSTS

MERCURY

Spacecraft	135,300,000
Launch Vehicles	82,900,000
Operations	49,300,000
Tracking Operations and Equipment	71,900,000
Facilities	53,200,000
Total	$392,600,000

GEMINI

Spacecraft	797,400,000
Launch Vehicles	409,800,000
Support	76,200,000
Total	$1,283,400,000

APOLLO

Apollo Program accrued costs through July 31, 1969; includes the first manned lunar landing: (amounts in millions)

Apollo Spacecraft		6,939
Saturn Launch Vehicle		7,940
Saturn I	767	
Saturn IB	1,127	
Saturn V	6,046	
Engine Development		854
Operations Support		1,137
Mission Control Systems	229	
Launch Operations	219	
Flight and Crew Operations	477	
Technical Support	212	
Tracking and Data Acquisition		541
Facilities		1,810
Manned Space Flight Facilities	1,631	
Tracking and Data Facilities	179	
MSF Center Operations		2,128
Total		$21,349

Launch vehicles and spacecraft on hand or in final production for manned lunar landing missions and other programs after July 1969:

7 Saturn IB Launch Vehicles
9 Saturn V Launch Vehicles
13 Spacecraft Command and Service Modules
9 Spacecraft Lunar Modules

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COST OF MISSIONS

Apollo 7		
Command & Service Module	$55	million
Saturn IB Launch Vehicle	45	"
Operations	45	"
	$145	"
Apollo 8		
Command & Service Module	$55	"
Saturn V Launch Vehicle	185	"
Operations	70	"
	$310	"
Apollo 9		
Command & Service Module	$55	"
Lunar Module	40	"
Saturn V	185	"
Operations	60	"
	$340	"
Apollo 10		
Command & Service Module	$55	"
Lunar Module	40	"
Saturn V	185	"
Operations	70	"
	$350	"
Apollo 11		
Command & Service Module	$55	"
Lunar Module	40	"
Saturn V	185	"
EASEP (lunar surface instruments)	5	"
Operations	70	"
	$355	"
Apollo 12 & 13 (per mission)		
Command & Service Module	$55	"
Lunar Module	40	"
Saturn V	185	"
ALSEP (lunar surface instruments)	25	"
Operations	70	"
	$375	"
Apollo 14		
Command & Service Module	$55	"
LM	40	"
Saturn V	185	"
ALSEP (same as other)	25	"
Operations	95	"
	$400	"

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Apollo 15	
Command & Service Module	$65 million
Lunar Module	50 "
Saturn V	185 "
ALSEP & Science payload	40 "
Operations	105 "
	$445 "
Apollo 16	
Command & Service Module	$ 65 million
Lunar Module	50 "
Saturn V	185 "
ALSEP & Science payload	40 "
Operations	105 "
	$445 "
Apollo 17	
Command & Service Module	$ 65 million
Lunar Module	50 "
Saturn V	185 "
ALSEP & Science payload	45 "
Operations	105 "
	$450 "
Estimated total cost of Apollo Program through completion	$25 billion

SKYLAB PROGRAM

Total cost of program	$2.6 billion

APOLLO HISTORICAL SUMMARY

Initial planning for a launch vehicle having a payload capability of the Saturn I began in April 1957. In August 1958, studies concluded that a clustered booster of 1.5 million pounds thrust was feasible and the research and development effort was begun. Initial results proved that the engine clustering technique, using existing hardware, could furnish large amounts of thrust.

Rocketdyne, a division of North American Rockwell Corp., updated the Thor-Jupiter engine, increased its thrust, thus developing the 200,000 pound thrust H-1 engine. Concurrently, from advanced studies, the 1.5 million pound thrust F-1 engine was conceived and subsequently used as the power plant for the even larger boosters.

In October 1958, the Army team moved to develop a high-performance booster for advanced space missions. Tentatively called Juno V and finally designated Saturn, the booster was turned over to NASA in late 1959.

In July 1960, NASA first proposed publicly a post-Mercury program for manned flight and designated it Project Apollo. The Apollo goals envisioned at the time were Earth-orbital and circumlunar flights of a three-man spacecraft.

During 1960, Douglas Aircraft Company, Inc. (now McDonnell Douglas) was selected to build the Saturn I second stage (S-IV) and Rocketdyne was chosen to develop the hydrogen fueled J-2 engine for future upper stages of the Saturn vehicles.

On May 25, 1961, President John F. Kennedy proposed to Congress that the United States accelerate its space program, establishing as a national goal a manned lunar landing and return by the end of this decade. In his report to Congress President Kennedy said:

"Now is the time...for this nation to take a clearly leading role in space achievement, which in many ways may hold the key to our future on Earth.

"...this is not merely a race. Space is open to us now; and our eagerness to share its meaning is not governed by the efforts of others. We go into space because whatever mankind must undertake, free men must fully share.

"No single space project in this period will be more impressive to mankind or more important for the long-range exploration of space...

"Let it be clear...that I am asking the Congress and the Country to accept a firm commitment to a new course of action, a course which will last for many years and carry very heavy costs... If we are to go only halfway, or reduce our sights in the face of difficulty, in my judgment it would be better not to go at all."

With endorsement by Congress, the national objective of manned lunar exploration created an immediate need for a considerably more powerful booster -- later designated the Saturn V. Following another six-month study, NASA announced in January 1962 that the Saturn V, using a cluster of five F-1 engines, would generate 7.5 million pounds of thrust, thus providing the liftoff power for the lunar landing program. After announcing that NASA would undertake the task of developing the Saturn V, contracts were awarded to Boeing Company and North American to build the first two stages of the Saturn V.

The second stage has a cluster of five J-2 engines developing a combined thrust of one million pounds. The third stage (S-IVB) and instrument unit were already under development for the smaller Saturn by Douglas Aircraft and IBM, respectively.

Later in 1962, NASA announced it was developing the Saturn IB which combined the first stage of the Saturn I and the top stage of the Saturn V for Earth orbital tests of the Apollo spacecraft.

On August 9, 1961, MIT was selected to develop the Apollo spacecraft guidance and navigation system. Three and a half months later, NASA selected North American Rockwell Corp. for the Apollo spacecraft command and service module program.

In mid-July 1962, the National Aeronautics and Space Administration selected the lunar orbital rendezvous mode for the lunar mission. This called for development of a two-man lunar module to be used for landing on the Moon and returning to lunar orbit. Grumman Aircraft Engineering Corp. was selected to design and build the lunar module on November 7, 1962.

One year later, the first Apollo command module was flown at White Sands Missile Range in a launch pad abort test. The first high altitude abort was successfully demonstrated on May 13, 1964. Fifteen days later a Saturn I placed the first Apollo command module into orbit from Cape Kennedy.

The first full systems Apollo command module was launched aboard a Saturn IB, and successfully tested the module's reentry heat shield. The February 26, 1966 test was also the first flight of a Saturn IB.

The first phase of the Saturn launch vehicle program was completed in 1965. In ten flights of the Saturn I, ten were successful -- an unprecedented record in rocket development. Much technology was proven in the Saturn I program. The rocket guidance system was developed. The concept of clustered rocket engines was validated and, the program supplied experience in using liquid hydrogen as rocket fuel. Liquid hydrogen provides double the fuel economy of earlier fuels.

The Saturn IB launch vehicle was successfully flown three times in three attempts in 1966. Two of these flights carried spacecraft to space where they satisfactorily completed requirements for Apollo command and service modules in Earth orbital operations.

On January 27, 1967, tragedy struck the nation space effort when a fire erupted inside an Apollo spacecraft during ground testing at Cape Kennedy, resulting in the deaths of Astronauts Virgil Grissom, Edward White II and Roger Chaffee. After two and a half months of investigation, involving 1,500 people, the Board of Inquiry determined that the most likely cause of the fire was electrical arcing from certain spacecraft wiring. After an extensive investigation by an Accident Review Board, the National Aeronautics and Space Administration followed with detailed descriptions of corrective actions, schedule modifications, and cost estimates necessary to move the program toward its objective.

On November 9, 1967, the first flight test of the Apollo/Saturn V space vehicle was successfully accomplished. Designated Apollo 4, the unmanned flight demonstrated performance of the previously unflown first and second Saturn V stages, the restart-in-orbit capability of its third stage, the Apollo spacecraft ability to reenter Earth's atmosphere at lunar mission return speeds, performance of the integrated space vehicle, and the operational readiness of Kennedy Space Center Launch Complex 39. All mission objectives were met following an on-time launching and an 8-hour 37-minute mission. The Saturn V placed a total weight into orbit of over 278,699 pounds after a near perfect countdown. The spacecraft heat shield performed satisfactorily during the 24,800 mile per hour plunge into Earth's atmosphere.

During the January 22-23, 1968 Apollo 5 mission, lunar module systems and structural performance met all objectives, including two firings of both the ascent and descent propulsion systems. The unmanned Lunar Module I was boosted into Earth orbit by a Saturn IB. Post-flight analysis determined the lunar module ready for manned Earth orbital missions.

The April 4, 1968 flight of Apollo 6 was the second unmanned Saturn V mission to demonstrate launch vehicle and spacecraft systems performance. Two problems were experienced with the rocket systems -- vertical oscillations of "POGO" effect in the first stage and rupture of small propellant lines in the upper stages -- in an otherwise, very successful mission.

The precise reentry and splashdown on October 22, 1968 of the 11-day Apollo 7 flight ended what was called a 101 percent successful mission. Manned by Astronauts Walter Schirra, Donn Eisele, and Walt Cunningham, the Apollo 7 performed flawlessly for more than 780 hours in space including eight firings of the spacecraft's primary propulsion system and the first live TV from a manned vehicle.

Apollo 8 lifted off precisely on time, December 21, 1968 from the Kennedy Space Center for history's first flight from Earth to another body in the solar system. Apollo 8 performed flawlessly for 147 hours and over a half million miles of space flight which included ten revolutions around the Moon, lunar and Earth photography, and live television broadcasts.

Apollo 9 splashed down in the Atlantic Ocean, northeast of Puerto Rico, at 12:00:53 EST, March 13, 1969, after a 10-day, 6-million mile Earth orbital mission. All major mission objectives were met in the first five days of flight. Apollo 9 was the first all-up manned flight of the Apollo Saturn V space vehicle, first manned flight of the lunar module, first Apollo EVA, and included rendezvous and docking, live television, photographic surveys of Earth, and observation of Pegasus II satellite and Jupiter. This was the fourth Saturn V on-time launch (11:00 am EST).

Apollo 10 successfully completed man's second lunar orbital flight, passing within 9 miles of the lunar surface in a dress rehearsal for the actual lunar landing mission. Lifting off at 12:49 pm, May 18, Apollo 10 spent nearly 62 hours (31 revolutions) in lunar orbit, sent 19 live color TV transmissions, and splashed down within 7,000 yards of its primary recovery ship in the Pacific Ocean eight days and three hours after launching.

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Apollo 11 attained the national goal, set by President Kennedy in 1961, of landing men on the Moon and returning them safely to Earth within the decade of the 1960's. The mission was launched precisely on time from Kennedy Space Center at 9:32 am EDT, July 16, by a Saturn V. The LM touched down in the Moon's Sea of Tranquility at 4:18 pm, July 20, and Commander Neil Armstrong stepped onto the lunar surface at 10:56 that evening followed by LM Pilot Edwin E. Aldrin, Jr. Their activities were viewed live around the world by the largest television audience in history. The returning spacecraft splashed down in the Pacific, southwest of Hawaii, at 12:51 pm EDT, July 24 after a flight of 8 days, 3 hours, 19 minutes. Scientific instruments were left on the Moon and samples of the Moon's soil and rocks were brought back, along with still and motion pictures.

Exactly four months after the Apollo 11 landing, the Apollo 12 repeated this achievement, landing and exploring at the Ocean of Storms, opening a new era in manned scientific exploration. The November 14 launched Apollo 12 mission demonstrated the point landing capability, and implaced the first Apollo Lunar Surface Experiments package on the surface for continued science reporting. Two EVA periods were completed by the astronauts, which included experiments emplacement, field geology investigation, and Surveyor III inspection. The crew for the 10 day 4.5 hour mission was commander, Captain Charles Conrad, Jr.; Command Module Pilot, Captain Richard F. Gordon, Jr.; and Lunar Module Pilot, Captain Alan L. Bean.

Apollo 13 was launched April 11, 1970 to land on the Fra Mauro upland area of the Moon where the crew would retrieve surface samples and emplace geophysical instruments during two EVA periods. A rupture of the service module oxygen tank at 10:11 pm EST, April 13 caused a power failure of the command and service electrical system which prevented the lunar landing. The crew used the lunar module as the command post and living quarters for the remainder of the flight. The lunar module descent engine provided propulsion to make corrections in the flight path which sent the spacecraft around the Moon on a free-return trajectory for reentry and splashdown in the Pacific Ocean 142 hours,54 minutes, 41 seconds after liftoff.

The Apollo 13 Review Board announced on June 30 that a short circuit ignited electrical insulation in the spacecraft oxygen tank No. 2, causing failure of the tank. The Board recommended the command and service module systems be modified to eliminate potential combustion hazards in high-pressure oxygen of the type revealed by the accident.

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The spacecraft was modified in accordance with the Board's recommendations for Apollo 14 to be launched no earlier than Jan. 31, 1971 to land on the Fra Mauro area of the Moon.

Apollo 14 accomplished the third manned lunar surface exploration mission. The spacecraft was launched at 4:03 p.m., Sunday, Jan. 31, 1971, and the lunar module touched down on the Moon at 4:17 a.m. EST Feb. 5 within 60 feet of the targeted point on the Fra Mauro formation. Landing coordinates were 3 degrees 40 minutes, 27 seconds South latitude: 17 degrees, 27 minutes, 58 seconds West longitude. Mission Commander Alan B. Shepard, Jr. and Lunar Module Pilot Edgar D. Mitchell successfully carried out two periods of extravehicular activity on the lunar surface; the first of 4 hours 50 minutes and the second for 4 hours 35 minutes, totalling 9 hours 25 minutes. They successfully deployed and activated the Apollo Lunar Surface Experiments Package, an array of geophysical instruments which are transmitting data on the Moon's interior and exterior environment to Earth. In addition, they collected 96 pounds of lunar rocks and soil, which included two rocks weighing about 10 pounds each, the largest obtained to date. After spending 33 1/2 hours on the Moon, the lunar module lifted off the surface at 1:47 p.m. Saturday,Feb. 6, 1971. The Earthbound portion of the mission was normal and the spacecraft landed in the South Pacific Ocean at 4:05 p.m. EST Feb. 9, 1971.

The fourth lunar landing mission, Apollo 15, was launched Monday, July 26, 1971 at 9:34 a.m. EDT. Modifications to the spacecraft permitted longer lunar surface staytime and additional scientific instruments in lunar orbit. The 12-day, 7-hour, 12-minute mission was commanded by astronaut David R. Scott, with command module pilot Alfred M. Worden, and lunar module pilot James B. Irwin. On July 30, at 6:16 p.m. EDT Scott and Irwin landed at the Hadley Apennine site, 26 degrees, 6 minutes North latitude and 3 degrees 39 minutes East longitude. During their 66-hour, 55-minute stay on the Moon they explored the lunar surface for a total of 18 hours, 36 minutes, retrieved approximately 170 pounds of surface samples, deployed geophysical instruments and described geological features. Command module pilot Worden conducted extensive scientific experiments while orbiting the Moon which included the operation of two cameras and gamma ray and X-ray sensors mounted in the service module. After 74 lunar revolutions and ejection of a subsatellite, the spacecraft began its Earthbound journey. Astronaut Worden egressed from the command module and retrieved the camera film during the transearth coast. The Pacific Ocean landing was August 7, 1971 at 4:46 p.m. EDT.

Apollo 16, the fifth lunar landing mission, was launched April 16, 1972 at 12:54 p.m. EST. The 11 day, 1 hour, 51 minute mission was commanded by astronaut John W. Young with Thomas K. Mattingly, II, as command module pilot and Charles M. Duke, Jr. as lunar module pilot. The spacecraft splashed down in the Pacific April 27. The lunar explorers returned approximately 210 pounds of Moon rocks and soil samples to Earth from the Descartes highlands. In lunar orbit Mattingly operated a complex array of scientific instruments, two lunar mapping cameras and observed geological features on the surface. A scientific subsatellite was placed in lunar orbit before the trans-Earth maneuver was performed. On the Earthbound trip Mattingly egressed from the spacecraft for 1 hour 24 minutes to retrieve the film canisters from the lunar cameras.

The final Apollo mission, Apollo 17, was launched December 7, 1972. On the 12-day mission astronauts Eugene A. Cernan, mission commander, and Dr. Harrison H. Schmitt, lunar module pilot, explored the Taurus-Littrow landing site, emplaced geophysical instruments and collected 243 pounds of samples. Total surface EVA time: 22 hours and 4 minutes. Ronald E. Evans, command module pilot, operated scientific instruments and cameras in lunar orbit and retrieved the camera film during a 1 hour, 6 minute inflight EVA enroute back to Earth. Splashdown in the Pacific occurred December 19.

SKYLAB SUMMARY

There were four launches in the Skylab Program, all from the Kennedy Space Center. First launch on May 14, 1973, by a two-stage Saturn V, placed the 100-ton Skylab space station in a 270-mile Earth orbit. The first crew to visit Skylab was launched May 25. Crew members were Navy Capt. Charles Conrad, Navy Commander Paul Weitz and Navy Commander (Dr.) Joseph Kerwin. Duration of the mission was 28 days and 49 minutes. The second crew was launched July 28; mission duration was 59 days, 11 hours and 9 minutes. Crew members were Navy Capt. Alan Bean, Marine Major Jack Lousma and civilian Dr. Owen Garriott. The third crew was launched Nov. 16; mission duration was 84 days, 1 hour and 16 minutes. Crew members were Marine Lt. Col. Gerald Carr, Air Force Lt. Col. William Pogue, and civilian Dr. Edward Gibson. Saturn IB's were used to launch the crews in modified Apollo spacecraft.

When the third and final manned Skylab mission splashed down in the Pacific February 8, 1974, the three crews had traveled 70.5 million miles over the 171 days, 13 hours and 14 minutes they had spent orbiting the Earth. They had circled Earth 2,476 times, during which they spent over 3,000 hours conducting eight categories of experiments. EVA time totalled 41 hours, 46 minutes. Data returned included 175,047 frames of solar observation film and 46,146 frames of Earth observation film. Approximately 238,600 feet of magnetic tape of Earth observations were also returned. A highlight of the third mission was extensive observation and photography of Comet Kohoutek. This mission of over 84 days increased the previous record length in space set by the second Skylab crew by about 50%.

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